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ORIGINAL ARTICLE

Effect of weather parameters on population dynamics of mustard aphid in *Brassica* Crop

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ABSTRACT

To assess the impact of weather parameters on mustard aphid, a field experiment was conducted during Rabi season 2021-2022,at Zonal Agricultural Research Station, Morena, Madhya Pradesh. Correlation coefficient of aphid population was found significantly negative correlated with minimum temperature in timely sown variety BSH-1 and IJ-31 and with morning relative humidity showed negative correlation in timely sown variety BSH-1. While, correlation coefficient of aphid population was also found significantly negative correlated between maximum temperature in late sown variety T-27, BSH-1, IJ-31 and GSC-6. Whereas, showed positive correlation between morning relative humidity and aphid population in late sown variety T-27, BSH-1, IJ-31 and GSC-6 and also showed positive correlation between evening relative humidity and aphid population in late sown varieties BSH-1, IJ-31 and GSC-6.

Keywords: *Aphid, Lipaphiserysimi, mustard, timely sown, late sown, weather parameters, population dynamics.*

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INTRODUCTION

Mustard is a member of the Brassicaceae or Cruciferae family. Various mustard species are grown as vegetables, fodder, and oilseed crops all over the world. Three hundred fifty genera and around three thousand five hundred species are present [8, 12-15]. There are 38 different insect pests that Indian mustard plants are vulnerable to, and these pests have been linked to lower oilseed yields in India [1, 4, 7]. The mustard aphid, *Lipaphiserysimi* (Hemiptera - Aphididae), is the main pest that causes a drastic drop in production and seed yields among the insect pests that are attacking the mustard crop in India. A serious and well-known insect pest, mustard aphid damages 9 to 96% of India's crops as a result of infestation [11, 16]. At every stage, mustard plants are overrun by the mustard aphid. Both nymphs and adults ingest the cell sap of mustard plant leaves, flowers, flower buds, pods, and twigs. Additionally, they produce a lot of sticky honey dew, which promotes the development of the sooty mould fungus that turns the leaves and pods a dirty black colour [2-9].

The population of insect pests is influenced by weather factors, and the sowing window is crucial for mustard aphids. The ability to predict the population of mustard aphids under various climatic scenarios using statistical methods is made possible by variations in aphid population with changes in weather factors.

MATERIAL AND METHODS

The current study was conducted in Rabi 2021–2022 at the Zonal Agriculture Research Station in Morena, Madhya Pradesh. Name of genotypes enlisted In Table1. The crop was sown on October 30, 2021, in a timely manner, and on October 23, 2021, in a late manner, at a seed rate of 5 kg/ha. During the crop period, the recommended fertilizer dose of 80:40:20 (N: P: K) kg/ha is used. Eight different varietal treatments made up the experiment's Randomized Block Design (RBD) structure. The rows and plants were spaced 30 cm apart in the area where the different kinds were sowed. Weather parameters viz. Maximum and minimum temperatures, morning and evening relative humidity and rainfall that have distinct influence in aphid population were counted (in situ) from 10 randomly selected plants in each replicated plot on 10 cm apical top twig at weekly interval starting from appearance of aphid infestation up to harvested of the crop and find out the correlation between aphid population and weather parameters. Correlation and regression of the abiotic factors on major sucking insect pest population were worked out by using the formula as suggested by [10].

RESULTS AND DISCUSSION

Correlation studies carried out between meteorological parameters and population of aphid, showed negative correlation (r= -0.78 and -0.80) between minimum temperature and aphid population in timely sown variety BSH-1, IJ-31. Whereas showed positive correlation (r=0.78) between morning relative humidity and aphid population in BSH-1 variety. (Table 1, 2]. Regression equation between the aphid population and minimum temperature and morning relative humidity were Y2=159.03+3.48X1, Y3=17.98+2.99X1 and Y2=0.04+1.27X1 (Fig no. 1,2 & 3), respectively. From the above equation it was concluded that with every one °C increase in minimum temperature, there was increase in 3.48 and 2.99 aphid population per plant in timely sown variety BSH-1 and IJ-31 respectively. Whereas 1% increases in morning relative humidity, there was increase in 1.27 aphid population per plant in variety BSH-1 (Fig no. 1,2 & 3), respectively. There was no significant relationship with maximum temperature, evening relative humidity and rainfall in timely sown varieties. Correlation studies carried out between meteorological parameters and population of aphid, showed negative correlation (r= -0.84, -0.78, -0.82 and -0.80) between maximum temperature and aphid population in late sown variety T-27, BSH-1, IJ-31 and GSC-6. Whereas showed positive correlation (r=0.85, 0.86, 0.86 and 0.89) between morning relative humidity and aphid population in late sown variety T-27, BSH-1, IJ-31 and GSC-6 (Table no. 1 &2). However, showed positive correlation (r=0.78, 0.78, and 0.81) between evening relative humidity and aphid population in late sown varieties BSH-1, IJ-31 and GSC-6 (Table no. 1 &2). Regression equation between the aphid population and maximum temperature and morning relative humidity and evening relative humidity were Y5 = 147.59-5.43X1, Y6 = 200.13-5.48X1, Y7 = 185.21- 4.94X1, Y8 = 185.74-3.93X1 and Y5 = -102.29 +2.01X3, Y6 = -64.34 +2.21X3, Y7 = -46.92 +1.90X3, Y8 = - 5.25 + 1.60X3 and Y6 = -22.43 +1.98X4, Y7 = -10.72 +1.70X4, Y8 = 24.92 +1.44X4 (Fig no. 1,2,3,4,5,6,7,8,9,10,11,12,13 & 14), respectively. From the above equation it was concluded that with every one °c increase in maximum temperature, there was decrease in 5.43, 5.48, 4.91, and 3.93 aphid population per plant in late sown variety T-27, BSH-1, IJ-31 and GSC-6, respectively. Whereas 1% increases in morning relative humidity, there was increase in 2.01, 2.21, 1.90 and 1.60 aphid populations per plant in varieties T-27, BSH-1, IJ-31 and GSC-6. Besides 1% increase in evening relative humidity, there was increase in 1.98, 1.70, and 1.44 aphid populations per plant in varieties BSH-1, IJ-31 and GSC-6. There was no significant relationship of minimum temperature, rainfall and also with evening relative humidity no significant for late sown variety T-27.

A correlation research was conducted between the weekly aphid population and the corresponding weekly weather parameters in order to determine the relationship between the aphid population and various weather parameters. Since aphid incidence was observed concurrently in both timely and late sowing dates, the population of aphid was averaged with the corresponding varieties and used for correlation analysis. The findings showed that minimum temperature and aphid population correlated significantly negatively, whereas morning relative humidity and aphid population correlated significantly positively with timely seeded varieties' aphid populations. In varieties that were sown on time, there was no correlation between the maximum temperature, evening relative humidity, and rainfall. The findings showed that research that correlated the population of aphids with meteorological parameters demonstrated a negative relationship between maximum temperature and aphid population. While the morning relative humidity and aphid population were found to be positively correlated. Additionally, demonstrate a positive correlation between the aphid population in late-sown varieties and the evening relative humidity. For late-sown variety T-27, there was no correlation between the minimum temperature, rainfall, and evening relative humidity. The number of aphids was shown to multiply more

as the maximum and lowest temperatures dropped. Gami *et al.,* [9] observed significant negative correlation of aphid population with maximum and minimum temperature. Ahuja [10] also observed negative association with maximum, minimum temperatures and sunshine hours with aphid population. Singh and Singh [11] observed positive effect of the maximum and minimum temperature, morning relative humidity and evening relative humidity and sunshine hours on the population of mustard aphid. While, similar study also conducted by Patel and Chandra [18], [21], Pradhan *et al.* [19] and Pal and Debnath [17].

Table 1: Observation of meteorological week against population of mustard Aphids

SWM	Meteorological Weeks	Average Weekly Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Aphid population on timely sown varieties				Aphid population on late sown varieties			
		Max. (°C)	Min (°C)	Mor.	Max. (°C)	Min. (°C)	T-27	BSH-1	IJ-31	GSC-6	T-27	BSH-1	IJ-31	GSC-6
50	10-16 Dec.2021	23.50	8.20	57.90	23.50	8.20	14.26	62.26	61.53	89.2	-	-	-	-
51	17-23 Dec.2021	21.00	6.90	62.30	21.00	6.90	16.40	62.93	63.46	87.26	-	-	-	-
52	24-31 Dec.2021	24.90	6.80	61.20	24.90	6.80	23.60	78.6	74.46	96.06	-	-	-	-
01	01-07 Jan.2022	20.70	9.60	74.40	20.70	9.60	35.00	88.73	84.2	106	35.00	88.73	84.2	106
02	08 Jan - 14 Jan	18.90	9.90	76.60	18.90	9.90	-	-	-	-	45.13	99.13	94.46	115.46
03	15 Jan - 22 Jan	16.60	6.00	70.00	16.60	6.00	-	-	-	-	55.13	107.02	102.46	117.2
04	22 Jan - 29 Jan	18.10	7.50	77.30	18.10	7.50	-	-	-	-	62.86	114.33	104.80	123.93

Table 2: Correlation coefficient of aphid population with meteorological parameters

Weather Parameter	Timely Sown Varieties							
	T-27		BSH-1		IJ-31		GSC-6	
	r	Regression Equation	r	Regression Equation	r	Regression Equation	r	Regression Equation
T max (°C)	-0.21	-	-0.15	-	0.18	-	-0.21	-
T min (°C)	-0.73	-	-0.78*	Y2=159.03+3.48X1	-0.80*	Y3=17.98+2.99X1	-0.66	-
RH1 (%)	0.72	-	0.78*	Y2=0.04+1.27X1	0.74	-	0.62	-
RH2 (%)	0.61	-	0.70	-	0.64	-	0.50	-
RF (mm)	0.22	-	0.32	-	0.29	-	0.17	-
Weather Parameter	**Late Sown Varieties**							
	T-27		BSH-1		IJ-31		GSC-6	
Tmax (°C)	-0.84*	Y5=147.59-5.43X1	-0.78*	Y6=200.13-5.48X1	-0.82*	Y7=185.21-4.94X1	-0.80*	Y8=185.74-3.93X1
Tmin (°C)	-0.02	-	0.02	-	0.01	-	0.12	-
RH1 (%)	0.85*	Y5=-102.29 +2.01X3	0.86*	Y6=-64.34 +2.21X3	0.86*	Y7=-46.92 +1.90X3	0.89**	Y8=- 5.25 + 1.60 X3
RH2 (%)	0.74*	-	0.78*	Y6=-22.43 +1.98X4	0.78*	Y7=-10.72 +1.70X4	0.81*	Y8=24.92 +1.44X4
RF (mm)	0.37	-	0.43	-	0.42	-	0.49	-

*= Significant at 5%, **= Significant at 1%

X = Weather Parameter, (X_1 = Maximum Temperature, X_2 = Minimum Temperature, X_3 = Morning Relative Humidity, X_4 = Evening Relative Humidity, X_5 = Rainfall)

Y = Aphid Population (Y_1 = T-27, Y_2 = BSH-1, Y_3 = IJ-31, Y_4 = GSC-6)

CONCLUSION

From the results it is concluded that correlation coefficient of aphid population was found significantly negative correlation with minimum temperature in timely sown variety BSH-1 and IJ-31. Whereas showed negative correlation with morning relative humidity in timely sown variety BSH-1. Correlation coefficient of aphid population was found significantly showed negative correlation between maximum temperature and aphid population in late sown variety T-27, BSH-1, IJ-31 and GSC-6. Whereas showed

positive correlation between morning relative humidity and aphid population in late sowed variety T-27, BSH-1, IJ-31 and GSC-6. However, showed positive correlation between evening relative humidity and aphid population in late sown varieties BSH-1, IJ-31 and GSC-6.

Fig. 1: Correlation between aphid population and maximum temperature on IJ-31 variety

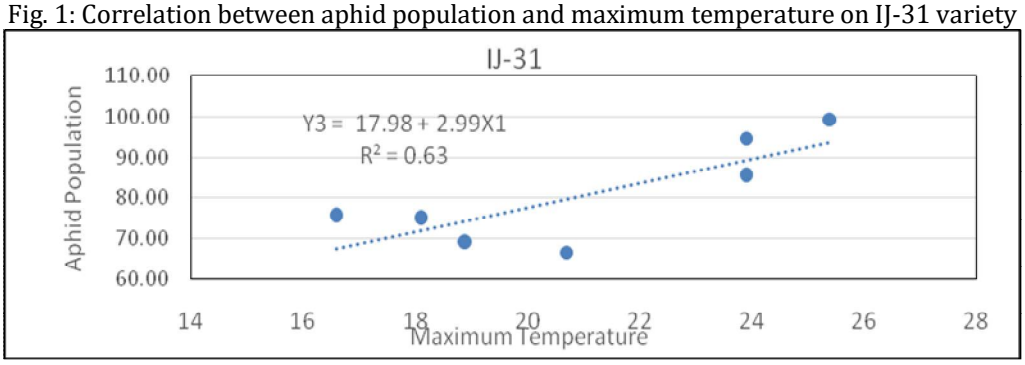


Fig 2: Correlation between aphid population and maximum temperature on BSH-1 variety

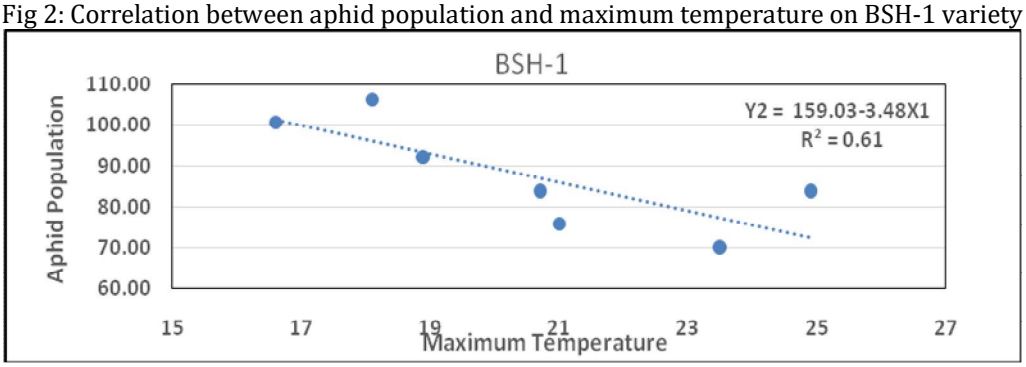


Fig. 3: Correlation between aphid population and morning relative humidity on BSH-1 variety

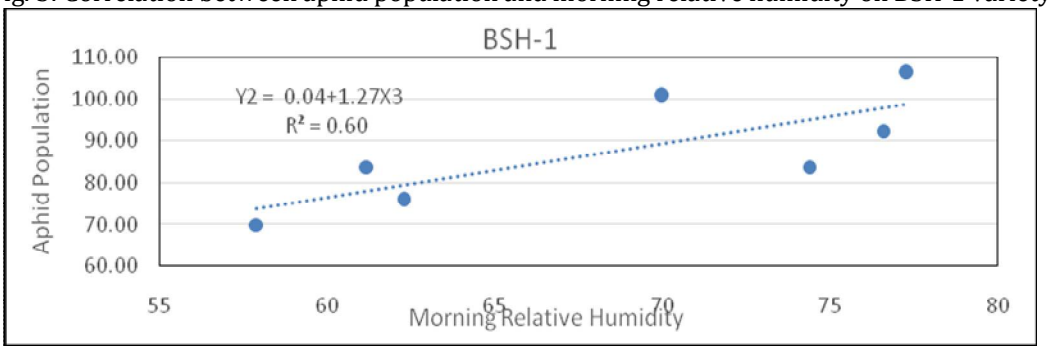


Fig. 4: Correlation between aphid population and maximum temperature on T-27 variety

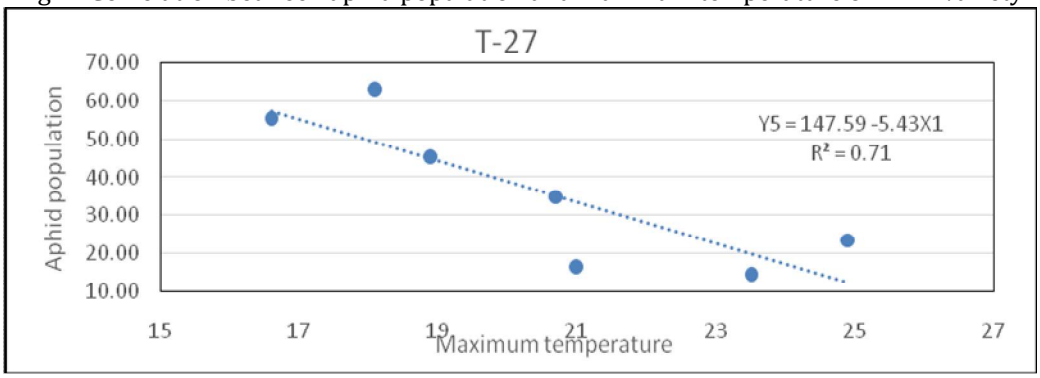


Fig. 5: Correlation between aphid population and maximum temperature on BSH-1 variety

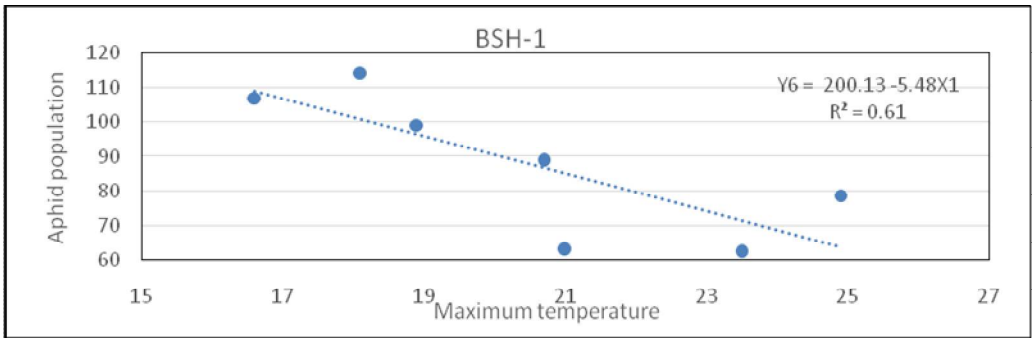


Fig. 6: Correlation between aphid population and maximum temperature on IJ-31 variety

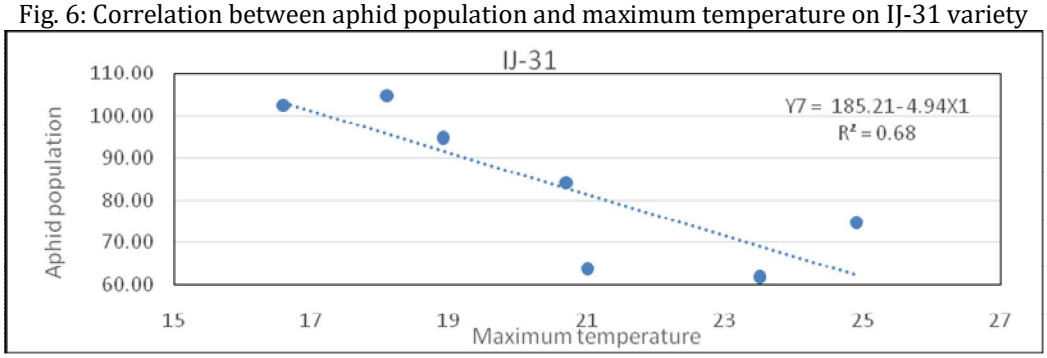


Fig. 7: Correlation between aphid population and maximum temperature on GSC-6 variety

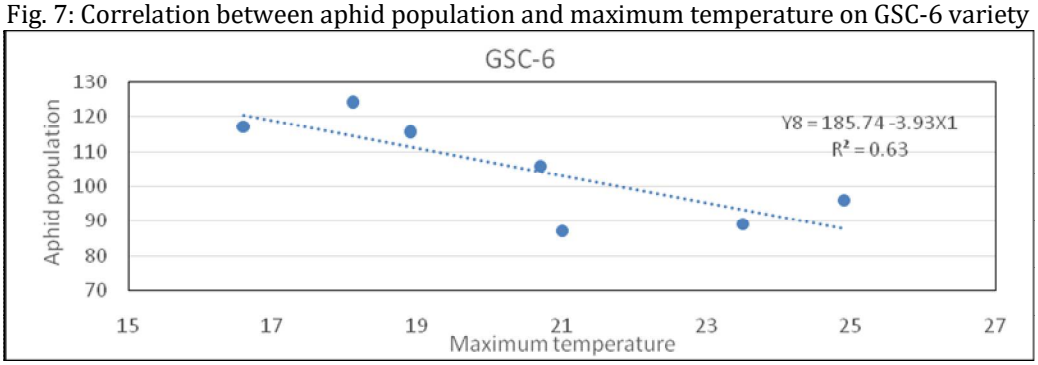


Fig. 8: Correlation between aphid population and morning relative temperature on T-27 variety

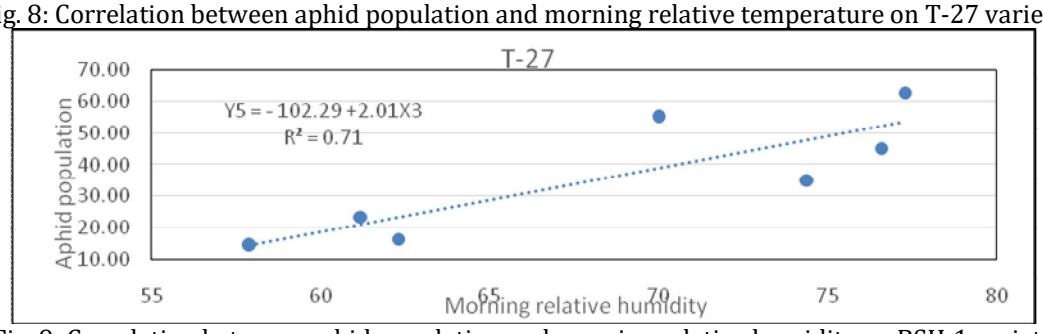


Fig. 9: Correlation between aphid population and morning relative humidity on BSH-1 variety

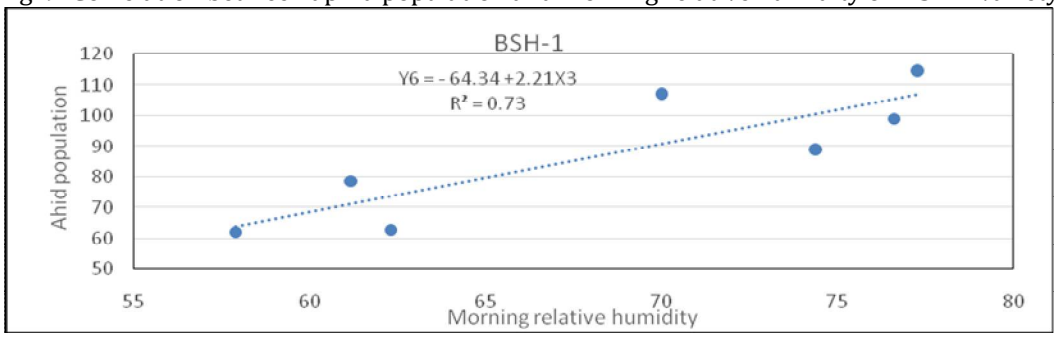


Fig.10: Correlation between aphid population and morning relative humidity on IJ-31 variety

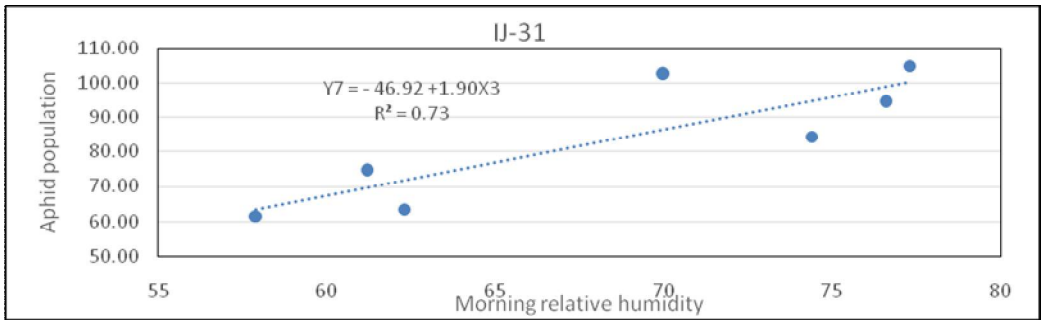


Fig.11: Correlation between aphid population and morning relative humidity on GSC-6 variety

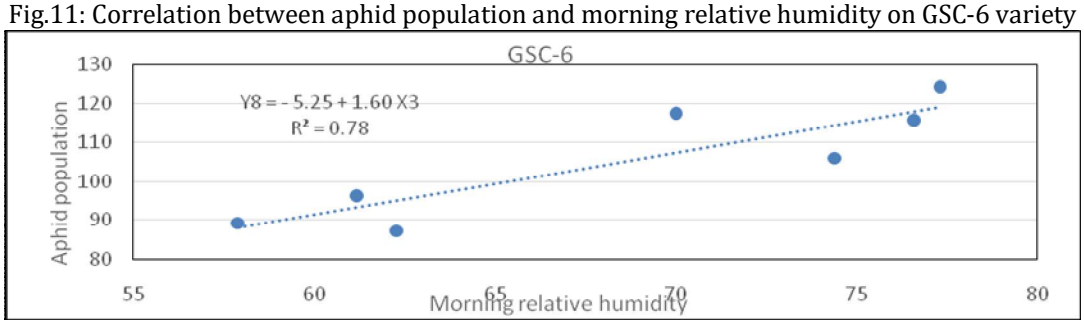


Fig. 12: Correlation between aphid population and evening relative humidity on BSH-1 variety

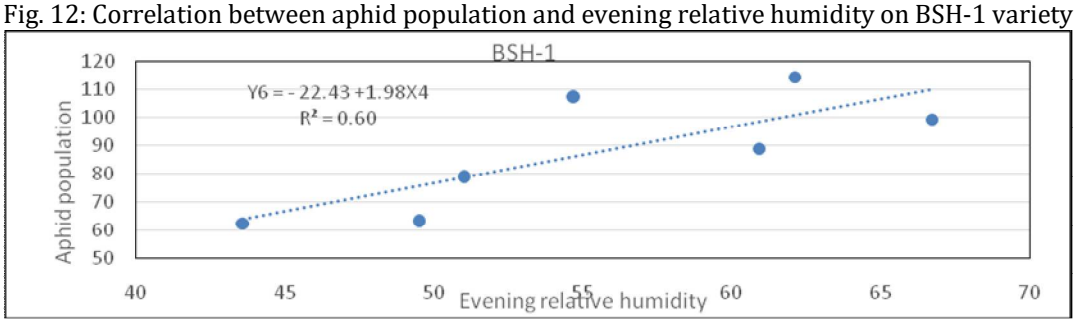


Fig. 13: Correlation between aphid population and evening relative humidity on IJ-31 variety

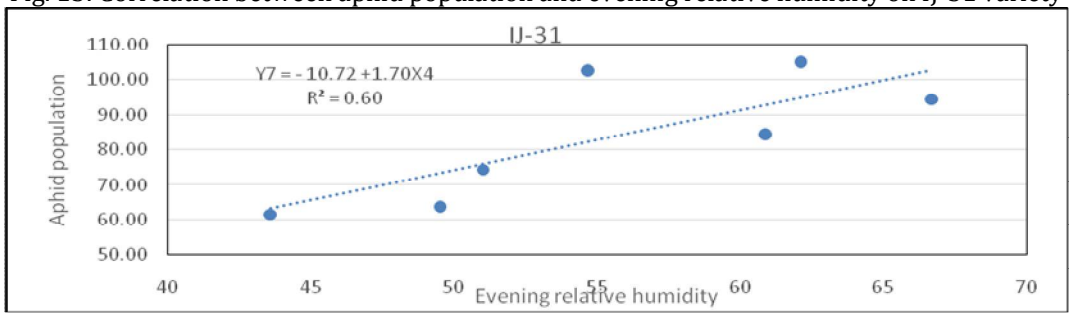
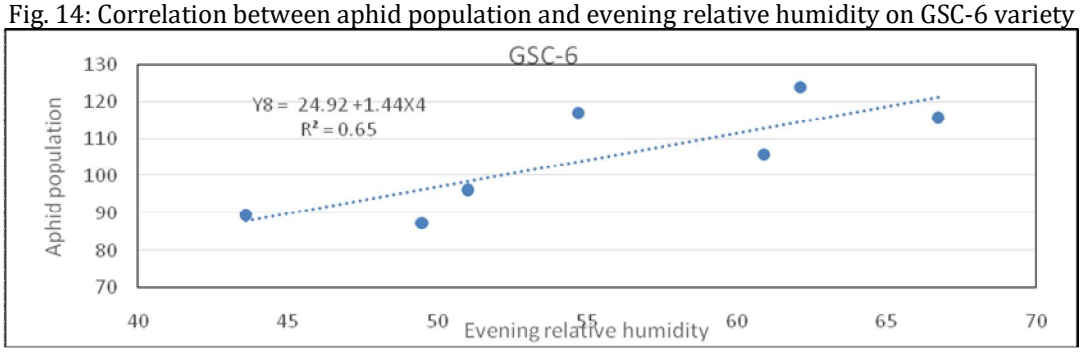


Fig. 14: Correlation between aphid population and evening relative humidity on GSC-6 variety



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